

Proposal Information Template for:

Portable, Plug-In, Luminous Signs for Indoor Use

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California Energy Commission

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Prepared for:

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Please note: all savings estimates and information in this document are preliminary and are based on data available to the authors at the time of the report. If the CEC moves forward with this topic, we anticipate updating our estimates and recommendations based upon additional input from stakeholders.

Proposal Information Template – Portable, Plug-In, Luminous Signs for Indoor Use

2011 Appliance Efficiency Standards

Prepared for: Pacific Gas and Electric Company, San Diego Gas & Electric, Southern California Edison, Southern California Gas Company

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Purpose

This document is a report template to be used by researchers who are evaluating proposed changes to the California Energy Commission's (Commission) appliance efficiency regulations (Title 20, Cal. Code Regulations, §§ 1601 – 1608) This report specifically covers: "Portable, Plug-in, Luminous Signs for Indoor Use."

Background

Portable, plug-in luminous signs are commonly used indoors by retail establishments and other venues where visual communication with customers, clients or visitors is essential for successful business and public activities. Based on our field observations and review of product offerings, we have identified many plug-in signs using inefficient light sources and power supplies, and many that either lack controls or use only manual on-off switches. Furthermore, we observe that many of the signs with manual on-off switches have broken or missing pull-cords and therefore they are needlessly operated 24 hours a day.

The goal in regulating these signs is to reduce on-peak power demand and annual energy usage, via a minimum energy-efficiency standard, expressed as a maximum input power demand (watts) per area (square feet). To reduce wasted hours of use, we suggest requiring a durable, easily accessible on/off switch, and, for signs with total face area greater than four square feet, we suggest requiring a supplemental control such as a photosensor, timer, or remotely-addressable or programmable timer.

Overview

Description of Standards Proposal	<p>Product: All self-contained, luminous sign units that plug into 120V AC building mains power and are intended for indoor use only. Signs may be intended for use in commercial outlets (business establishments), or, in residences. (This proposal excludes luminous outlines and channel letters that are hard-wired.)</p> <p>Alternative light sources for signs that are internally-illuminated by lamps are described in Appendix A.</p> <p>Metric for efficiency: power density, per sign face (watts per square foot, W/sf). Until we can conduct further laboratory research and/or have input from the portable sign industry, we suggest a minimum efficiency of <u>15 W/sf</u> for all products except electronic message center signs (EMC), for which we suggest <u>40 W/sf</u>. (Note that these requirements may be adjusted when we update our 2010 online and catalog survey, and, if we conduct a laboratory study.)</p>
California Stock and Sales	<p>As of end of Q4, 2014, we estimate the following stock and sales.</p> <p>Installed stock: 3.35 million units</p> <p>Annual sales of new signs: 0.33 million units</p> <p>Annual growth rate, for 2014 onward: 1.0%</p>
Energy Savings and Demand Reduction	<p>Energy savings, annual, after stock turnover: 250 GWh</p> <p>Peak demand reduction: 23MW</p>
Economic Analysis	<p>We anticipate that the proposed changes would add no more than 10% (approximately \$8 to \$10) to the average cost of a sign unit. The estimated present-value, lifetime savings costs would be \$124 per unit. The lifecycle net benefit per sign unit is thus \$112 to \$114. The total annual avoided energy costs after stock turnover would be approximately \$37.2 million.</p> <p>Our market research indicates that most portable, plug-in, luminous signs are manufactured outside of the State of California, and many are manufactured outside the United States. The first cost of required improvements per sign is offset by significantly lower operating costs (no or fewer lamp replacements), so we do not anticipate any loss of sales due to the regulation. Thus, we do not anticipate any change in the California economy, revenue or jobs.</p>

Non-Energy Benefits	Non-energy benefits from the proposal are positive. Assuming that many new signs under this proposal use LEDs, then signs should have low or no maintenance costs, no mercury, and minimal lead (in solder) in the signs. End-of-life disposal or recycling should be less burdensome due to lower weight and more benign materials. In cases where neon is replaced with LEDs, the electrical operating requirements are typically low-voltage, reducing fire and electrical shock hazards. Furthermore, because LED signs typically are formed from plastic or metal, they are less prone to break accidentally than are signs with glass lamps or tubes.
Environmental Impacts	The proposal does not create any adverse environmental impacts. Due to lower energy use, atmospheric emissions (including ozone-depleting gases) should decrease. Efficient sign products weigh less than conventional sign products and are smaller in some dimensions, so environmental and energy impacts associated with manufacturing, packaging, and shipping to the job site will be reduced relative to the base case. LEDs in particular do not contain mercury or lead, as do many of the existing lamp types in signs. Thus, the reduced quantities of materials needed for manufacturing should involve less mining and less material to dispose of at end of product life.
Acceptance Issues	<p>Many local jurisdictions have stringent sign regulations. Localities differ greatly in their requirements; however, most local regulations focus on outdoor signage. Some local laws do, however, apply to signage displayed in windows.</p> <p>A label could increase purchaser awareness of the energy and environmental benefits of new products. Requiring a label would support targeted incentive programs such as rebates to distributors, headquarter rebates to chain store procurement offices, or coupon and take-back programs for small, independent businesses.</p> <p>If most portable signs are imported into the United States, then some international outreach may be required to inform importers and manufacturers of the regulation.</p>

Federal Preemption or other Regulatory or Legislative Considerations	<p>Signs are a form of free speech and are considered an operational right for businesses. Thus, the proposed regulation should be worded to allow manufacturers and users aesthetic design flexibility.</p> <p>The only federal legislation presently addressing energy efficiency in signs is in EPCACT 2005, but it applies only to exit signs, which are usually hard-wired, not portable.</p> <p>Any federal legislation pertinent to lamps may also affect lamps used in signs, although unusual lamp types or lamps dedicated to special use (such as single-color lamps or vibration-resistant incandescent bulbs) may be exempted from federal rules.</p> <p>California Appliance Efficiency Regulations 1605.3 Table K applies to incandescent lamps used in signs.</p> <p>California Title 24, Part 6, Section 148 pertains to signs.</p>
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Methodology and Modeling Used in the Development of the Proposal

We observed, counted and photographed signs in the field in numerous types of businesses in several locations in northern and southern California, and we reviewed manufacturers' literature and websites offering catalogs of products. See Appendix B for more details on market research.

The authors consulted with PG&E's staff (Steve Blanc, Gary Fernstrom and Pat Eilert) and the PG&E Title 24 consultants who worked on sign component and system issues, including Michael Neils and HMG. The authors attended several industry trade shows where we met and interviewed sign manufacturers and distributors (International Sign Association 2007 and 2009 and LightFair annually from 2007 to 2011). We participated in Underwriter Laboratories' LED workshop held in Chicago in 2007. We consulted with SCE prior to submitting our previous draft template, and in April 2009, with SCE we co-presented a summary of an earlier version of this proposal to members of the International Sign Association (ISA).

We devised a model to allow us to input assumptions and data from the field, government sources, and from catalogs. For numbers of outlets (business establishments reporting sales tax) we used data from the State of California Board of Equalization (CA BOE), for 2010. For numbers of households, we used U.S. Census data for California, for 2010. For notes on other assumptions in the model, see Appendix C.

We used the model to establish a base case for the end of 2013, assuming that this proposal would take effect on January 1, 2014. The model includes the following items and factors:

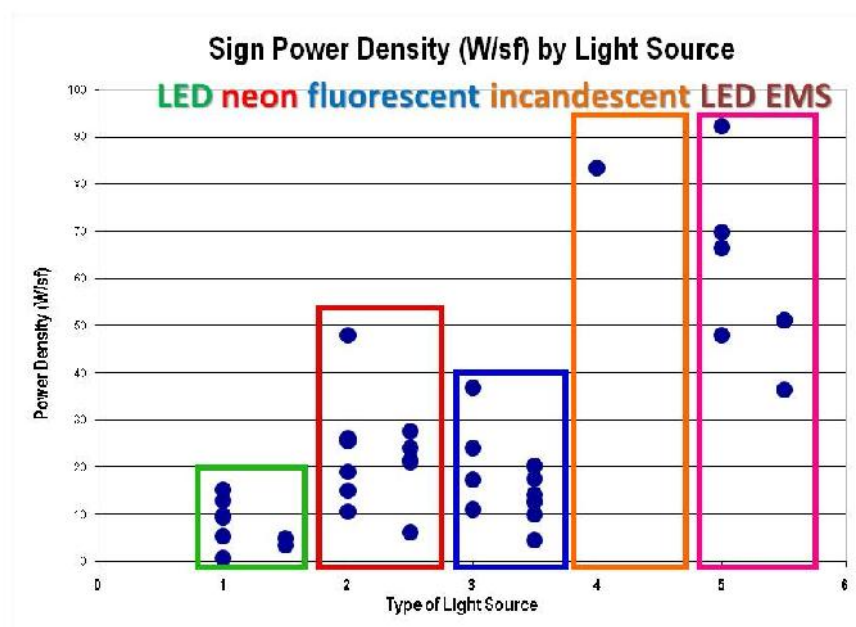
- Numbers of outlets (businesses) and residential units
- Average number of sign units per outlet (from our field observations)
- Average input power demand per sign unit (estimated, from our observations, literature and retailer surveys)
- Average daily hours of use, per sign, per type of outlet (from our field observations and from published hours of outlets' operations)
- Average annual growth of stock (estimate)
- Trend toward increased efficiency of signs (estimated, from literature)
- Average annual growth in number of outlets ("slow growth" scenario, post-recession)

From the above information, the model calculates our estimates of:

- Total number of signs per type of outlet (base case, end of 2013)
- Total input power demand for all signs, per type of outlet (base case, end of 2013)
- Total average daily and annual sign energy use, per type of outlet (base case, end of 2013)
- State totals, with no intervention, and, with intervention (through 2023)
- Savings totals, with intervention, 10-year cumulative (through 2023)

From our survey of catalogs and online offerings in 2010 we plotted a distribution of power density by light source type for plug-in, portable signs. (Given additional time and resources, we suggest updating this survey with current information and more data points.) The points shown in the figure below are selected to show the range of power density available in the market, but they do not represent a weighted distribution of product offered or sold. We would appreciate any input from the California sign industry on sales data for number of signs sold, by light source type and size (area, in square feet), and by wattage.

Figure 1. Range of power density for signs, by type of light source.



Left to right: LED; neon; fluorescent; incandescent; and, LED electronic message center sign (EMC). Points shown represent only a range of power density; they do not represent a weighted distribution of data.

Data, Analysis, and Results

Signs are ubiquitous for businesses. They are acquired or changed frequently. Generally the market trend is toward increased numbers and use of signs of all types, bolstered by targeted marketing by sign retailers, economic development programs and small business advocacy campaigns. Retailers and users view LEDs favorably and some recognize the relatively low energy demand of LEDs compared to conventional light sources for plug-in signs.

California and national sign industry associations and representatives previously participated in the 2005 Title 24 regulatory process for outdoor signage. We anticipate that any resistance to regulation that is perceived as economically burdensome could be counterbalanced by the industry's desire to increase sales and profits post-recession and to be regarded as offering environmentally friendly products. Industry representatives expressed concern with meeting a power density requirement, but they did not propose a practical alternative to this method. We believe that the EPACT 2005 federal legislation requiring energy-efficient exit signs is a favorable precedent for this proposal, as is the inclusion of signs in California 2005 Title 24.

Table 1. Summary of results from the model: base case, market without and market with intervention, and estimated savings.

Metric	Base Case: Q4 2014	No intervention: Q4 2023	With intervention: Q4 2023	Savings due to intervention
Number of plug-in signs in operation	3,337,690	3,479,380	3,479,380	--
Daily average input power demand attributed to plug-in signs	140 MW	131 MW	117MW	15 MW
Daily average energy use attributed to plug-in signs	2,100 MWh	1,973 MWh	1403 MWh	570 MWh
Annual average energy use attributed to plug-in signs	767,440 MWh	720,020 MWh	512,010 MWh	208,010 MWh

Next steps: Before implementing the proposal, the project team should update field observations used for our assumptions because signage is influenced by marketing trends and thus has a fast turnover rate in the market. For example, new styles of LED signs are gaining popularity, especially those that are dynamic, multi-color electronic message center signs (EMC). Our present data for power density of signs is based on manufacturer-published information, so the project team should also conduct lab tests to verify the manufacturers' sign dimensions and wattage ratings.

If the State or utilities consider offering incentives for efficient plug-in signs in advance of the regulation's effective date, our model can be used as a tool to examine the types of businesses that would be potential targets for outreach, education, and incentive marketing.

Proposed Standards and Recommendations

We based our proposal partly on language and test requirements in the Federal regulations for exit signs, which originated with the U.S. ENERGY STAR Exit Sign Program. When the standard for testing signs (UL 48) is published, this proposal should be harmonized to reflect any updates in testing. See Appendix D for our proposed plug-in sign language, summarized below, and Appendix E for a description of the scope of UL 48.

Proposed Title 20 requirements for all portable, self-contained luminous sign units that plug into 120V AC building mains power and are intended for indoor use only.

A. Input power demand:

Establish a maximum power density (W/sf) based on the area of the sign face(s). The maximum levels should allow more than one type of light source to comply with the regulation, except for LED electronic message center signs (EMC), which shall have a separately defined maximum level.

B. Controls:

Each sign shall have an integral toggle switch or remote switch for ON/OFF control.

For signs with a face area >4sf, the sign shall include a supplemental time-of-operation control, such as a photosensor, timer, or remotely addressable timer.

C. Labeling:

Plug-in signs should bear a label clearly stating input power demand at maximum usage setting.

Text may include instructions on how to set controls to minimize hours of use.

Bibliography and Other Research

Avery, Douglas. Title 24 and the sign industry, 2011 and beyond. Southern California Edison. Presentation at ISA Expo, April 2009.

Avery, Douglas. Title 24 and 20 2008: Nonresidential Sign Lighting. Presented for Gary Flamm, CEC. Southern California Edison. Updated for presentation at ISA Expo, April 2009.

Brown, Richard E., and Jonathan G. Koomey. 2002. "Electricity Use in California: Past Trends and Present Usage Patterns." *Energy Policy*. vol. 31, no. 9. (also LBNL-47992).

California Energy Commission. 2004. Update of Appliance Efficiency Regulations. California Energy Commission. CEC Publication # 400-04-007D; Appendix A, Table 22. July 2004.

California Energy Commission. 2007. Appliance Efficiency Regulations. December 2007. CEC-400-2007-016-REV1. Revised December 29, 2007. Sacramento, CA.

California Energy Commission (CEC). 2011. "Statewide Average Customer Class Electricity Prices". Electricity Rates Combined. Excel.
<http://energyalmanac.ca.gov/electricity/index.html#table>

Energy Solutions. 2011. Cost Avoidance Calculator. September. Microsoft Excel. Based on Update of Appliance Efficiency Regulations. California Energy Commission. CEC Publication # 400-04-007D; Appendix A. July 2004

Higa, Randall. 2008. SCE Title 20 AB 1109-Related Efforts. CEC Workshop, January 15, 2008, Sacramento, CA.

Southern California Edison. 2007. Codes and Standards Project Neon Scoping Study (Draft). CS 07.01 Draft Report. Prepared by Design & Engineering Services, Customer Service Business Unit. October 2, 2007.

State of California, Board of Equalization. News Release: California State Board of Equalization Specialists Verify Business Permits. August 5, 2011. Accessed at: www.boe.ca.gov/news/2011/93-11-G.pdf

Stevens, Amanda. Potential Title 20 opportunities: signage and sign power supplies. Presentation on behalf of PG&E at ISA, April 2009.

Swormstedt, Wade. The 2008 Electric State of the Industry Report. *Signs of the Times*, July 2009, pp 68-76.

Swormstedt, Wade. The 2011 Electric State of the Industry Report. *Signs of the Times*, July 2011, pp 64-69.

U.S. Census 2010. Accessed at:

http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_NSRD_H1&prodType=table

U.S. Energy Policy Act of 2005. Public Law 109—58. Accessed at:

<http://www.gpo.gov/fdsys/pkg/PLAW-109publ58/content-detail.html>

U.S. Environmental Protection Agency. Energy Star Exit Sign Program. Version 3 (last and most recent) accessed at:

http://www.energystar.gov/index.cfm?c=archives.exit_signs_spec. Version 2

(referenced in EPACKT 2005) remains accessible at:

http://edocket.access.gpo.gov/cfr_2010/janqtr/pdf/10cfr431.204.pdf

Additional Websites Visited:

California Sign Association: www.calsign.org

International Sign Association. www.signs.org

Signs of the Times

Signpower! News and Views of the United States Sign Council.

www.ussc.org/newsletters

Signweb.com

UL 48 Standard for Electric Signs. Underwriters Laboratory. Note: Revised version due to be published in late 2011.

United States Sign Council: www.ussc.org


References and Appendices

Appendix A. Light Sources Used in Portable, Plug-In Signs

Some plug-in signs are designed to use screw-base incandescent or fluorescent lamps. The lamp(s) may or may not be included in the original purchase of the sign, but the electrical safety information on the sign should indicate the type and maximum wattage of lamp allowable for use in the sign. The users of the sign may subsequently substitute other types of lamps that fit the existing bases inside the sign.

The effect of the proposed regulation will be that sign manufacturers fit their products with presently available components such as CFL pin-bases and high efficiency ballasts. They should also instruct users to use the most efficient lamps available for each sign.

Figure 2. Light sources presently used in plug-in signs, with alternative sources (in italics).

<p>Internally Illuminated Rectangular Box or Panel (Examples: text may read, "OPEN," or, show brand name or logo)</p>	
<p>Screw-base incandescent → <i>pin-based CFL with electronic ballast</i></p>	
<p>Linear fluorescent (FL) → <i>lower wattage FL with electronic ballast</i></p>	
<p>Screw-base compact fluorescent (CFL) → <i>pin-base CFL with electronic ballast</i></p>	
<p>Neon → <i>neon with efficient transformer; or, LED panel or lamp</i></p>	



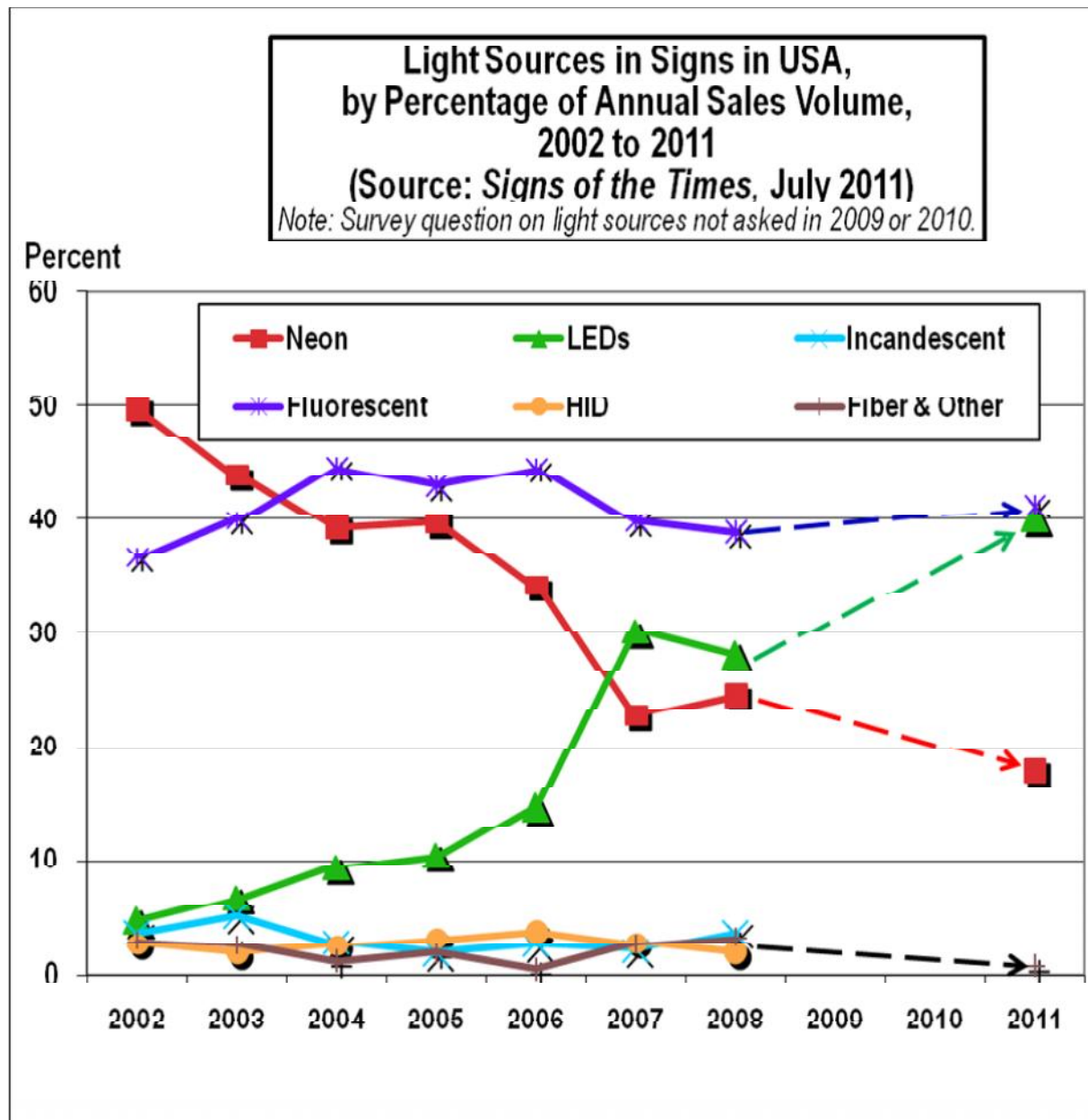
<p>Internally-Illuminated Stanchion, Pole or End-Cap (Examples: text may read, “NEXT,” or, display a number)</p>	
<p>Screw-base incandescent → <i>pin-based CFL with electronic ballast</i></p>	
<p>Screw-base compact fluorescent (CFL) → <i>pin-based CFL with electronic ballast; or, LED panel or lamp</i></p>	
<p>Graphic or Text, Some with Dynamic Effects (Examples: text may read, “OPEN,” or, show brand names or logos, or prices)</p>	
<p>Neon → <i>neon with efficient transformer; or, LED</i></p>	
<p>LED → <i>LED with high efficiency driver</i></p>	

Figure 3. General Trend in Use of Light Sources, by Type, in Signs.



The *Signs of the Times* annual questionnaire is directed to sign manufacturers in general, and thus the results are not limited to portable, plug-in signs. However, we are using this trend chart to give a general sense of the increasing popularity of LEDs versus neon and fluorescent as light sources in signs.

Appendix B: Market Research

Interviews

We conducted phone interviews with representatives of nine online retailers of portable, plug-in signs, in December 2009. We asked about supply and distribution of signs, types of customers, trends in technology, cost to operate the signs, energy efficiency options and other topics pertinent to this report. The companies granting interviews included:

- All Neon Signs
- Arter Neon
- Bright Neon Signs
- Buy a Sign Online
- Change-a-Brill
- Jantec
- Keg Works
- Neon Sign & Décor
- Neon Sign World

Sign Data

We reviewed and compiled data on plug-in signs from the online and print catalogs of 31 plug-in sign retailers, in late 2009. We recorded size (dimensions), wattage, light source, additional features (dynamic options, controls, programmable, etc.) and retail price, for several hundred models of signs. Retailers included:

- All Neon Signs
- Arter Neon Signs
- Best Sign Store
- Big Beam
- Bright Neon Signs
- Budget Lighting
- Buy a Sign Online
- Change-a-Brill
- Directional Systems
- EGL Neon
- Empress Neon
- Everbrite Online
- Eye Flow Neon Signs
- Firehouse Neon
- Glasswerks Neon Sign
- Jantec Neon
- Keg Works
- LED Display Signs
- LightWorld
- My Neon Haven
- Neon Design-a-Sign
- Neon Nites
- Neon Sign
- Neon Sign Online
- Neon Sign World
- Neon Signs 4 U
- Neon Signs and More
- Neon Signs Depot
- Online Neon Signs
- Signs Direct
- The Neon Store

Appendix C: Notes and Assumptions for Model for Plug-in Signs

Number of outlets, per type of business: We are using the State of California Board of Equalization (CA BOE) numbers for 56 types of establishments in California that collect sales tax. By the CA BOE's admission, these numbers are an underestimate. Also, the reported types of "outlets" (businesses) do not include all types of buildings that use plug-in signs. For example, schools and churches and medical offices sometimes use plug-in signs. Thus, our estimates are conservative.

Number of outlets, per type of business (adjusted x 1.035): We used the CA BOE estimate of 3.5% of non-reporters to increase the numbers of businesses that are actually operating signs. Source: News Release: California State Board of Equalization Specialists Verify Business Permits. August 5, 2011.

CA Residential Housing Units, Occupied: From U.S. Census 2010. U.S. Census, 2010.

CA Residential Housing Units, Occupied, future dates: We use the same growth assumptions as we do for businesses.

Average number of signs, per outlet, commercial (*Please note that outlet means, "business establishment," not an electrical wall outlet*): Based on field observations in 2007 to 2008. This field needs updating, especially for total numbers, types and wattage of signs.

Average number of signs, per residence: We estimate one sign per 1800 housing units, Sports and other brand-affiliation signs now are widely available in big-box retailers and school-affiliated stores, as well as through online retailers. Residents display favorite brands and teams in family rooms, entertainment centers, and dorms.

Average input power demand, per sign: Needs to be verified in field by counting numbers of signs and estimating wattage or observing labels on signs. We suspect that increased popularity of electronic message center signs (EMC) may be building load. Also, we should test signs in a laboratory to determine actual demand of signs, versus manufacturers' stated ratings

Average daily hours of use of signs: Needs to be verified in field, now that NAICS replaced SIC; the groupings of types of businesses are different than we used previously. We previously did a search of types of businesses and their hours, online; this could be updated, too.

Total average daily sign power use, per type of business: We suspect that more types of businesses operate every day than did previously. Weekday-only businesses are shown as using signs for 8.6 hours on average per day (12 hours per day x 5 / 7 days in week).

Increase in number of outlets, from 2010 to end of 2013 ("economic recovery and slow growth scenario"): We use a very conservative net growth rate of 1% per year,

compounded to 6% for the period. Most forecasts show “business starts,” but do not include net numbers of businesses, so we are making our best effort estimate.

Trend factor for increasing efficiency of signs, from 2010 to end of 2013: We base this 4% decrease in input power demand per sign on the continuing trend toward purchases of LED signs versus older light source technologies. However, the decrease is mitigated somewhat by the increased use of energy-intensive LED electronic message center signs. These are expensive (\$250 and up) but very useful for convenience stores and other fast turnaround retailers. We would appreciate input from industry on this trend.

Increase in number of outlets from Q1 2014 to Q4 2023 ("slow growth"): We use a 1% net growth per year, compounded for 10 years, for an overall 10-year growth rate of 1.105%.
Trend factor for increasing efficiency of signs, 2014 through 2023, no intervention: We project an increase in efficiency of 10% (demand reduction of 0.9) on the continuing trend toward purchases of LED signs versus older light source technologies, still mitigated somewhat by the increased use of energy-intensive LED electronic message center signs. We assume a 10-year life per sign. This is shorter than the expected lifetime for hard-wired signs because plug-in signs are less durable and more subject to replacement as businesses change.

Trend factor for increasing efficiency of signs, 2014 through 2023, with intervention: We project an increase in efficiency of 20% (demand reduction of 0.8) due to the continued market trend toward efficient LED signs, and also, due to the Minimum Efficiency Performance Standard (MEPS) that we propose, of a watts-per area metric. We assume a 10-year life per sign.

Average daily hours of use of signs (reduced from 2010): We project a decrease in hours of use due to the proposed requirement for improved durability on/off switches (toggles, remote control, etc.) and also, due to the option of meeting the MEPS in signs greater than four square feet in area by the addition of timers or photosensors or other controls.

Annual sales: Until we can obtain information from CA sign industry, we assume that annual sales are 10% of the total installed base of signs.

Incremental cost per unit (above conventional): The retail price of signs has dropped dramatically during the recession. Static or blinking LED signs cost the same as or less than conventional neon signs; however, the cost of electronic message center signs (fully programmable, with single or “full-color” options) is considerably more than simpler signs. We estimate that the cost of the improvements we suggest for the regulation would add no more than 10% to the price of any plug-in sign. Cost of improvements would include lower w/sf (for neon this could be achieved with better quality neon tube+fill, with better transformers, and/or with less neon tubing per sign. LED sign prices would not likely be affected much by the new requirements. The option to have more sophisticated controls would be a moderate additional cost. We need input from industry on incremental costs for components.

Present value lifetime energy savings per unit and annual avoided energy costs after stock turnover: We utilized CEC rates (CEC 2011) and a cost avoidance calculator based on previous Title 20 methodologies (Energy Solutions 2011).

Appendix D. Proposed Language for Title 20.

Reference document: *2010 Appliance Efficiency Regulations*, (California Code of Regulations, Title 20, Sections 1601 through 1608) effective January 1, 2011, adopted by the California Energy Commission on November 18, 2009. Accessed on 3 October 2011 at: <http://www.energy.ca.gov/appliances/2010regulations/index.html>

Insert in Title 20, Section 1601. Scope.

(x) Portable, plug-in, luminous signs for indoor use.

Insert in Title 20, Section 1602. Definitions.

X. Definitions: Below are the definitions of relevant terms in this document.

X.1 Portable, Plug-In, Luminous Sign for Indoor Use (“portable, plug-in sign”): A sign equipped with an electric cord for connecting the luminous unit to mains power. The sign incorporates one or more light sources and may have one or more faces.

X.2 Portable, Plug-In, Luminous Sign Model (model): For the purposes of CA Title 20, a sign model is a sign in the configuration that is actually packaged and sold to CA end users under a unique model number or name. For sign models with an individual rechargeable battery, the battery charger shall be included as part of the exit sign model and shall be tested and qualified as a single product. The product shall be rated for indoor use.

X.3 Input Power Demand (power demand): The amount of active power required to continuously illuminate a sign model at full light output, measured in watts (W). For sign models with variable messages, input power demand shall be measured with all possible light sources in operation simultaneously. For sign models with rechargeable batteries, input power demand shall be measured with batteries at full charge.

Insert in Title 20, Section 1603. Testing: All Appliances.

X. Test Procedure: Manufacturers are required to perform tests to determine if the product model meets the energy-efficiency performance specifications in Table X-1, above. All performance measurements and calculations must be completed as described.

X.1 Test Conditions to Determine Whether Product Meets Energy-Efficiency Performance Specifications in Section X.x (*Note: this is will be updated in a subsequent version*)

X.1.1 Provide all voltages within $\pm 0.5\%$ by means of a constant voltage power supply.

X.1.2 Prior to measuring input power, operate the sign model at the rated input voltage and frequency for a period of 100 hours at 25 deg. C +/- 10 deg. C.

For a sign model with an internal battery, operate the sign from the battery for one-and-one-half hours and then recharge for the period that is specified by the sign manufacturer.

X.1.3 All of the light sources in the sign model, illuminated when the primary power source is available, must produce light throughout the first 100 hours of operation, before any

measurements are taken, in order to meet the requirements of this regulation.

X.1.4 Measurements should be recorded at 25 deg. C +/- 10 deg. C.

X.1.5 Total of the calculated area of all sign faces that are luminous, in square inches:

X.2 Test Conditions to Determine Whether Product Meets Energy-Efficiency Power Factor in Section (*Note: this is will updated in a subsequent version*):

X.2.1 Input power demand measurement: The input power demand of the sign model in its entirety shall be measured with a power analyzer with a basic accuracy of at least 0.5%. For a sign model that includes a battery, the battery circuit shall be connected and the battery fully charged before any measurements are made.

X.2.2 Power factor measurement: At the time of testing for input power demand, the voltage, current, power factor, and frequency shall also be measured with the same power analyzer as in Section 3.2.1.

Testing results shall include the following measurements taken at the power cord of the sign:

- Voltage (V rms)
- Current (A rms)
- power Power (W)
- Power factor (PF)
- Frequency (Hz)

Insert in Section 1605.3 State Standards for Non-Federally-Regulated Appliances.

(x) Portable, Plug-In, Luminous Sign

X.1. The power usage of a portable, plug-in, luminous sign shall not be greater than the applicable values shown in Table X-1.

Table X-1. Standards for Portable, Plug-in, Luminous Signs.

Sign Function	Maximum Power Density (W/sf)
Image or message	15
Electronic message center sign (EMC)	40

X.2 Controls:

X.2.1. Each sign must be equipped with at least one manual or automatic means of control for on/off electrical function.

X.2.2. Signs that have total input power demand equal to or greater than 40 watts must be equipped to offer one or more control features that reduce input power demand by at least

50%, such as (but not limited to): timer for hours of operation; bi-level dimming; continuous dimming; or, automatic photosensing for dimming (set to highest luminance during daylight hours, lowest luminance during night hours). These signs shall be set at the factory and shipped to market with the default control for operation set to its minimum input power demand. User instructions must identify the input power demand (or range of demand) for each controls setting.

X. Labeling

Text to be developed and harmonized with other Title 20 or Federal appliance label requirements.

X. Submittal of Compliant Product Data to CEC.

Text to be developed and harmonized with other Title 20 compliance requirements.

Appendix E: Sign Testing and Listing

Underwriter Laboratories (UL) offers several categories in which manufacturers can submit signs and sign components for electrical safety testing. UL publishes design guides to its online listings of certified manufacturers. The text relevant to plug-in signs is excerpted from "UXYT.GuidelInfo Signs."

Use and Installation: "This category covers electric signs employing incandescent lamps, LEDs (light-emitting diodes), electro-luminescent panels, neon tubing, fluorescent lamps, high-intensity-discharge lamps or combinations thereof for installation in accordance with Article 600 of ANSI/NFPA 70, "National Electrical Code."

Cord-and-plug-connected signs do not have provision for permanent mounting to a building or structure. Due to servicing considerations, specific types of cord and plug-connected signs are intended and have provision for installation on end-use equipment."

Related Products: "Changing message center signs may contain integral controllers or may be intended for use with externally connected controllers. Externally connected controllers are covered under Sign Controllers, Message Centers (UYTQ)."

Requirements: "The basic standard used to investigate products in this category is UL 48, "Electric Signs.""

"Electric signs that comply with the requirements in UL 153, "Portable Electric Lamps" may also be Listed as Portable Lamps (QOWZ) in the Electrical Appliance and Utilization Equipment Directory."

UL Mark: "The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up Service. The Listing Mark for these products includes the UL symbol (as illustrated in the Introduction of this Directory) together with the word "LISTED," a control number, and the product name "Indoor Electric Sign," "Electric Sign" or "Electric Sign Section.""

To get a sense of how many manufacturers are involved in sign manufacturing, we reviewed UL's list of certified sign manufacturers. As of 14 September 2011 we found the following numbers of sign manufacturers:

General coverage sign program listings ("UXYT"): Total ~<1760; USA ~<1700; ~<255 CA. (Some manufacturers have more than one sign program listing.)
Changing message sign program listings ("UYFS"): Total 25. Elsewhere in this report we refer to these products as electronic message center signs (EMC).

SCOPE OF STANDARD: *UL 48 SIGNS* (<http://ulstandardsinfonet.ul.com/scopes/0048.html>)

1.1 These requirements cover all electric signs, art forms and outline lighting for use in accordance with the National Electrical Code, NFPA 70.

1.2 Electric signs include all signs (regardless of voltage) that are electrically operated and/or electrically illuminated, including but not limited to the following methods of illumination: incandescent, fluorescent, high intensity discharge (HID), electric discharge tubing including neon tubing, light-emitting diode (LED), skeleton neon tubing, cold-cathode lamps, and electroluminescence. Unless otherwise noted the term "sign" includes signs, outline lighting, art forms, and skeleton neon tubing.

1.3 Electric signs covered by these requirements also include, but are not limited to, awning signs, trailer-mounted signs, electrically or mechanically animated signs, signs supplied by photovoltaic systems and other independent power sources, changing message signs, including scrolling, flipper, tri-view, liquid crystal display (LCD), and light-emitting diode (LED) type and other electrically operated signs that are not necessarily illuminated.

1.4 These requirements do not cover the following:

- a) Illuminated clocks operating at 600 V or less; refer to the Standard for Household Electric Clocks, UL 826 or for commercial use clocks to the Standard for Time-Indicating and -Recording Appliances, UL 863;
- b) Exit signs; refer to the Standard for Emergency Lighting and Power Equipment, UL 924;
- c) The trailer of a trailer mounted sign;
- d) Luminaires mounted to function as outline lighting; refer to the Standard for Luminaires, UL 1598;
- e) Luminaires mounted within an Awning Sign; refer to Standard for Luminaires, UL 1598;
- f) Signs that do not use electricity;
- g) Luminaires intended for billboard illumination; refer to Standard for Luminaires, UL 1598;
- h) Fiber optics or Fiber optic Illuminators;
- i) Signs for use in hazardous (classified) locations as defined in the National Electrical Code, NFPA 70."

CA TITLE 24, REGARDING SIGNS

UL states that it cooperates with California to help sign manufacturers comply with Title 24 (excerpt below). Note, however, that sign manufacturers may work with other listing and testing organizations to comply with Title 24 and all other regulations regarding electrical safety and testing of products.

UL and UL Environment, working with the California Energy Commission (CEC) and sign industry representatives, have developed a program to assist sign manufacturers demonstrate compliance with the energy conservation requirements within Title 24, of the California Energy Commission's Building Energy Efficiency Standards.

The CEC adopted sign lighting regulations on January 1, 2010. The requirements for signs can be found in the 2008 Building Energy Efficiency Standards, Title 24, Part 6, Section 148 of the California Code of Regulations.

The published sign lighting standards address both indoor and outdoor signs, and include mandatory automatic control requirements for all illuminated signs. In addition, the standards set limits on installed lighting power for internally and externally illuminated signs.

There are two alternate methods to comply with the 2008 sign lighting standards.

- Watts per square foot – sets maximum power per sign area
- Specific Technology – uses only energy efficient lighting technologies

UL48 sign manufacturers now have the option to apply the UL environmental Mark to signs that demonstrate compliance to one of the lighting power alternatives described above in lieu of having a licensed contractor perform the evaluation on each sign. The UL Safety Mark and the UL Energy Verified Mark will always appear together on signs covered under this new program.”